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A significant portion of coal resources are under Federal lands which are leased by the Department of the Interior to private entrepreneurs for mining purposes. In a previous report, GAO concluded that estimates of resources on existing leases did not provide a sound basis for forecasting production potential. Findings/Conclusions: This conclusion has not changed. Interior's recoverable reserve estimates were based on general recovery factors and not on detailed economic analyses. Wide variations existed between Interior and leaseholder estimates, with leaseholder estimates generally better supported. However, both the Geological Survey and leaseholders omitted some underground coal in computing recoverable reserves. The Survey does not have requirements for nonproducing leaseholders to provide cost and pricing information; producing leaseholders submit selling price information with production royalty reports. No coal production occurred before 1977 on 87% of the 219 leases reviewed. The Mineral Leasing Act of 1920, as amended, requires leaseholders to satisfy conditions of diligent development and continued operation, and coal production requirements were further defined in 1976 regulations issued by Interior. Application of these requirements depends on accurate reserve estimates. Recommendations: The Secretary of Interior should: publish reserve estimate methodology regulations for comment and hold public hearings on them; as an interim measure, require Survey to use the published estimating criteria contained in its bulletin, and review and update all reserve estimates on existing leases--when diligent development or

continued operations requirements are not met, leases should be terminated; obtain from leaseholders reserve estimates, cost, and pricing data, and develop procedures for analyzing this information in estimating recoverable reserves; and consider acquiring computer capability to provide for more effective and timely determination of reserve estimates. (HTW)

6968

BY THE COMPTROLLER GENERAL

Report To The Congress OF THE UNITED STATES

Inaccurate Estimates Of Western Coal Reserves Should Be Corrected

An accurate estimate of coal under Federal lease, and information on lessee development plans is essential for supporting coal leasing policy decisions. Better estimates are needed to relate Interior leasing with the administration's goal of increasing domestic coal production.

Interior's recoverable reserve estimates are based on general recovery factors--not detailed, current economic analysis; using unreliable estimates in enforcing laws would produce inadequate production controls, increase the chances for speculative holdings, and be against the public interest. Wide variations existed between Interior and leaseholder estimates; leaseholder estimates were generally supported better. But many leaseholder estimates were incomplete because they did not consider all underground coal. GAO considers neither Interior nor leaseholders estimates accurate or reliable.

No coal was produced before 1977 on most Federal leases; about 212 million tons may be produced annually by 1985.



EMD-78-32
JULY 11, 1978



COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-169124

To the President of the Senate and the
Speaker of the House of Representatives

This report presents our review of the accuracy of coal estimates under Federal lease and information on the leaseholders' past production on Federal leases and their current production plans until calendar year 1985. The report was requested by the Chairman, Committee on Energy and Natural Resources, and the previous Chairman, Subcommittee on Public Lands and Resources.

There is no question that coal will play an important part in the Nation's energy future. The relative importance of coal as an energy source, however, will largely be shaped by policies yet to be developed. This report should be helpful in assisting the Congress to make the sound decisions needed to develop a suitable Federal coal leasing policy.

We made our review using authority granted under Title V of the Energy Policy and Conservation Act (42 U.S.C. 6381-6384) and pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget, the Secretary of Energy; and the Secretary of the Interior.


Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

INACCURATE ESTIMATES OF
WESTERN COAL RESERVES SHOULD
BE CORRECTED

D I G E S T

Coal is the most abundant domestic fuel mineral, and a significant portion is under Federal land. The Department of the Interior leases these coal lands to private entrepreneurs for mining purposes.

In order for the Government to make sound coal leasing policy decisions, to manage the Federal coal leasing program effectively, and to comply with Federal law, accurate and reliable estimates of these reserves are essential. Timing also is important because many of the 537 outstanding leases may require "diligent development" determinations prior to June 1, 1986. Most Federal leases had no coal production before 1977.

However, Interior and leaseholder estimates of recoverable coal reserves are not accurate or reliable.

In a previous report 1/ on the Federal coal leasing program, GAO stated that Interior should have as clear a conception as possible of the potential contribution of Federal lands toward meeting the national coal production goal. At that time, GAO concluded that the estimates on existing leases did not provide a sound basis for forecasting production potential. That conclusion has not changed.

For this report GAO reviewed the reserve estimates and production projections of both Interior and the leaseholders for the top 20 Federal coal leaseholders. These

1/"Role of Federal Coal Resources in Meeting National Energy Goals Needs to be Determined and the Leasing Process Improved," RED-76-79, Apr. 1, 1976.

leaseholders controlled about 75 percent of the total estimated recoverable reserves on Federal leases as of September 1976 and included 219 of the then-537 outstanding Federal leases.

Interior computed reserve estimates on all Federal leases in 1973 within a 30-day period. Most of the estimates were based on judgments by mining supervisors and their staffs rather than on detailed analysis of all available geologic data. Interior has updated some estimates, but none of them were based on Interior standard estimating criteria.

Interior recoverable reserve estimates are based on general recovery factors and not on detailed current economic analyses, thus allowing for inaccurate estimates. This situation exists even though Interior estimating criteria require that economics be considered in determining recoverable reserves.

Leaseholders' reserve estimates were generally better supported by geologic evidence. However, many leaseholder estimates were not reliable because they did not consider all underground coal on the lease in computing recoverable reserves. In any case, the U.S. Geological Survey does not routinely obtain leaseholder reserve estimates.

A method for computing reserve estimates within the Federal Government has been agreed to between the Bureau of Mines and the U.S. Geological Survey. However, Survey does not follow its own method and industry uses different methods and parameters in computing recoverable reserve estimates.

RESERVE ESTIMATES

For the 219 leases reviewed, the leaseholders computed an estimate of 10.5

billion tons of recoverable coal. This is 18 percent lower than the 12.8-billion-ton estimate computed by the U.S. Geological Survey.

Wide variations existed between Interior and leaseholder estimates on individual leases because of differences in the estimating method and because Interior considered underground coal in its estimates when leaseholders did not. Interior's estimates for 21 leases were more than 100 percent higher than leaseholder estimates.

Ten leaseholders with 71 leases did not include underground reserves even though their geologic evidence supported the presence of underground coal. Survey estimates showed about 1.1 billion tons of underground recoverable coal on these leases. Many leaseholders were operating or planned to operate a surface mine for periods of 20 to 40 years and therefore included no reserve estimates for underground coal. They did not consider the underground coal to be reserves as far as their operations were concerned; therefore, these coal reserves may never be recovered.

Furthermore, GAO analysis showed the existence of more underground coal than indicated by either Survey or leaseholder records. This occurred because both Survey and leaseholders omitted some underground coal seams.

Survey 1973 estimating criteria, which Survey did not consider in preparing estimates, required that economics be considered in determining recoverable reserves but did not specify the economic considerations that should be included. Geological Survey Bulletin No. 1450-B contains the current estimating criteria. It also requires that economics be considered, but does not specify the type or source of such

information. No requirements exist for nonproducing leaseholders to provide cost and pricing information to Survey. Producing leaseholders submit selling price information with production royalty reports.

PRODUCTION

No coal production had occurred before 1977 on 190 (87 percent) of the 219 leases included in GAO's review. The leases had been held an average of about 7-1/2 years. Lack of coal demand was a major reason leaseholders gave for nonproduction.

Leaseholders plan to produce 212 million tons of coal annually by 1985 on 113 leases. About 131 million tons of this planned production from 45 leases is already under contract.

The importance to the Nation's future coal production of the planned production from the Federal leases becomes particularly apparent when it is compared to the increased production necessary to meet the administration's 1985 goal. To meet the administration's goal, the Nation's annual coal production must increase by 528 million tons from the 1977 estimated production of 672 million tons--a total increase of about 79 percent. The committed production in 1985 would provide about 25 percent of the necessary increase in coal production to meet that goal. The planned production from Federal leases for 1985 would account for about 40 percent of the necessary increases.

The Mineral Leasing Act of 1920, as amended, required that leaseholders satisfy the conditions of diligent development and continued operation. However, the conditions were not expressly defined in terms of coal production requirements until May 28, 1976, when Interior issued revised leasing regulations.

Unfortunately, the new diligent development, continued operation regulations, and advance royalty provisions will not be effectively or equitably applied because the reserve estimates are not accurate or reliable. The leaseholder's recoverable reserves estimated for 77 leases exceed Survey estimates by 1.4 billion tons. For 139 leases, Survey estimates exceed leaseholders' estimates by 3.6 billion tons. If leaseholders' estimates are more reliable, the diligent development requirements will be understated on 77 leases by about 34 million tons and overstated on 139 leases by about 89 million tons. Likewise, continued operation requirements will be understated annually by about 14 million tons on the 77 leases and overstated annually by about 36 million tons on the 139 leases.

Of the 219 Federal coal leases we reviewed, 101 were not included in mining plans submitted for Survey approval. The 101 leases contained 3.4 billion tons of leaseholder-estimated recoverable coal.

RECOMMENDATIONS

The Secretary of the Interior, in cooperation with the Secretary of Energy, must improve the accuracy and reliability of reserve estimates. We recommend that the Secretary of Interior:

- Publish reserve estimate methodology regulations for comment and hold public hearings so that a standard methodology can be developed and understood between industry and Government.

- As an interim measure, require Survey to use the published estimating criteria contained in Geological Survey Bulletin No. 1450-B for determining estimates, and review and update all reserve estimates on existing leases. First priority should be given to producing leases and leases scheduled to come into production within the next 5 years to assure that the diligent development, continued operation, and advance royalty provisions will be accurately assessed. When diligent development or continued operations requirements are not met by the leasees, as required by law, the leases should be terminated.
- Obtain from leaseholders reserve estimates, cost, and pricing data and develop procedures for analyzing this information in estimating recoverable reserves.
- Consider acquiring computer capability to provide for more effective and timely determination of reserve estimates.

AGENCY COMMENTS

Comments on this report were solicited from the Departments of Energy and Interior. Specific comments from each agency are reprinted as appendixes I and II. The Department of Energy agreed with the report recommendations, but requested that they be expanded to include the responsibilities of the Department of Energy. GAO accommodated that request. The Department of Interior raised a variety of objections to the report. The principal objections were that:

- GAO placed strong emphasis in the report on the use of a "gross" reserve figure for managing the coal leasing program;
- GAO's concern that using existing coal reserve estimates in carrying out the requirements of the Federal Coal Leasing Amendments Act of 1975 would result in

program inequities is not valid since existing Survey regulations, procedures, and a recently funded program will preclude any inequities; and

--there is no need for GAO to recommend that reserve estimates, cost, and pricing data be obtained from leaseholders since this is already a general requirement.

GAO disagrees with Interior's objections. GAO responses to these objections and other comments furnished by Interior are discussed in detail in chapter 5. (See pp. 30 to 33.,

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ABBREVIATIONS

GAO	General Accounting Office
LMU	Logical mining unit
PRLA	Preference right lease application
Survey	U.S. Geological Survey

GLOSSARY

Advance royalties	Royalties assessed when continued operation is not satisfied.
Coal structure map	A map which shows the location of the coal bed in relation to the surface topography.
Committed production	Forecasted coal production for which the leaseholder has negotiated a sales contract.
Continued operation	A minimum production level that must be achieved annually after diligent development has been satisfied.
Diligent development	A minimum production level which must be achieved during the first 10 years of lease life.
Inplace reserves	That part of the identified coal resources that is of minable depth and thickness.
Isopach map	A map which shows contour lines connecting points of equal seam thickness. This map is commonly used to measure the quantity of coal reserves.
Logical mining unit (LMU)	Coal land that can be developed and mined in an efficient, economical, and orderly manner with due regard to the conservation of coal reserves and other resources. An LMU may consist of one or more Federal leaseholds and may include intervening or adjacent non-Federal lands, but all lands in an LMU must be contiguous, under the effective control of a single operator, and capable of being developed and operated as a unified operation with complete extraction of the LMU reserves within 40 years from the first approval of a mining plan for that LMU.

Planimeter	An instrument used to measure an area. Coal acres are estimated by moving the instrument over the map's surface and obtaining readings on the instrument's measurement scales.
Planned production	Forecasted coal production which the leaseholder expects to mine if the coal is sold.
Preference right lease application	An application for a lease which will be issued if the applicant has discovered commercial quantities of coal. The application can only be made for lands under prospecting permit before the Coal Leasing Amendments Act of 1975.
Recoverable reserves	That part of the inplace reserves that can be mined using current technology and economics.

CHAPTER 1

INTRODUCTION

Coal is the most abundant domestic fuel mineral, and a significant portion of this resource is located on Federal land. Coal resources are larger in total heat value than the combined heat value of domestic petroleum, natural gas, and oil shale; however, most of the energy now consumed in the United States is produced from oil and natural gas.

THE NATIONAL ENERGY PLAN AND THE ROLE OF COAL

One main objective of the administration's proposed National Energy Plan is to reduce the U.S. dependence on foreign oil and its vulnerability to supply interruptions. The plan states that even with vigorous conservation the U.S. demand for energy will continue to grow. During the remainder of this century the Nation will have to rely mainly on conventional energy sources to meet its demand. The administration estimates that implementing the plan would increase coal production to 1.2 billion tons by 1985. Without the plan, the administration estimates that coal production will reach 1 billion tons by 1985. This amounts to increases of 535 and 335 million tons, respectively, above the 1976 coal production level. In a previous report ^{1/} on U.S. coal development, we discussed the implications of reaching coal production levels of about 1 billion tons by 1985--the level the administration estimates that the Nation will achieve without its plan. In that report we stated that given all the physical, economic, environmental, and public health considerations, it appeared to us that producing and using even 1 billion tons per year by 1985 would be very difficult.

The Nation's coal production increased 27 percent from 1965 to 1975--a 2.4-percent annual increase. An 85-percent increase over the 1975 annual production (about a 6.5-percent annual increase) is needed in the following decade to meet the 1.2-billion ton goal by 1985--this is an unlikely occurrence.

^{1/}"U.S. Coal Development--Promises, Uncertainties,"
EMD-77-43, Sept. 22, 1977.

Principal targets for future coal development are the States west of the Mississippi that, according to Department of the Interior information, contain about 54 percent of the 437 billion tons of demonstrated 1/ coal reserves. These western lands are rich in low-sulfur coal--a factor critically important because of the sulfur emission limits called for under the Clean Air Act (42 U.S.C. 1857, as amended). Western coal is also generally easier and more economical to produce because much of it is strip minable and because western land is usually easier to acquire in tracts large enough to be profitable to mine. The Federal Government owns about 60 percent of the western coal reserves and can influence the development of another 20 percent bordering on Federal land.

Interior records show that 50.4 million tons of coal were produced from Federal lands in 1977. Although this amount is small relative to the reserves estimated to be on Federal leases, it is six times the 1965 production of 5.9 million tons from Federal lands.

ADMINISTRATION OF FEDERAL COAL RESERVES

The Congress has passed several laws that provide for Federal coal development. Under the Mineral Lands Leasing Act (30 U.S.C. 181) and the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351), Federal lands containing coal deposits (except certain specifically excluded lands) may be leased for coal mining. The Mining and Minerals Policy Act of 1970 (30 U.S.C. 21a) states that the Federal Government has a role in fostering and encouraging private enterprise in the orderly economic development of domestic mineral resources and reserves.

On December 29, 1976, pursuant to the Federal Coal Leasing Amendments Act of 1975 (Pub. L. 94-377, Aug 4, 1976, 90 Stat. 1083), Interior established minimum production levels for the diligent development and continued operation requirements of the act. The minimum production levels apply to both existing and future leases. The act also requires Interior to conduct an exploration program to estimate recoverable coal on Federal lands.

1/Demonstrated coal reserves include coal for which estimates of the type, quality, and quantity have been computed partly from sample analyses and measurements and partly from reasonable geologic projections. The projections are made for an area no greater than 3/4 mile from the point of observation or measurement.

The information acquired as a result of the exploration is, among other things, to be used as a basis for

- improving the information on the value of public resources and the revenues which should be expected from leasing and
- assessing the amount of coal resources on those lands subject to the act.

The Department of Energy Organization Act (Pub. L. 95-91, Section 2, Aug. 1977, 91 Stat. 567) transferred the responsibility for establishing production rates on Federal leases from the Secretary of the Interior to the Secretary of Energy.

The Act also transferred to the Secretary of Energy the functions to promulgate regulations which relate to the

- fostering of competition for Federal leases,
- implementation of alternative bidding systems authorized for the award of Federal leases, and
- establishment of diligence requirements for operations conducted on Federal leases.

The Bureau of Land Management and the U.S. Geological Survey in the Department of the Interior are the agencies responsible for the management and disposition of Federal coal resources. The Bureau issues coal leases while the Survey provides scientific, technical, and economic advice to the Bureau to assist in making decisions to lease coal. The Survey monitors leases for compliance with the lease provisions, operating regulations, and statutes, and also collects royalties.

The Survey is also responsible for obtaining and maintaining accurate reserve estimates for leased Federal coal. In November 1973 the Survey Director required Survey's area mining supervisors to develop reserve estimates for each Federal coal lease. Recoverable coal estimates were 16.2 billion tons for 536 leases and 9.3 billion tons for 192 preference right lease applications (PRLAs). Survey subsequently revised the lease estimates to 17.3 billion tons for 537 leases. The total PRLA reserve estimate was not changed. The estimates were made over the period of only 1 month, did not adhere to Survey estimating criteria, and did not consider economic factors.

Interior stopped issuing coal leases and prospecting permits in 1971 after a Bureau study showed that the coal acreage under lease was increasing but production was decreasing. Interior issued no coal leases or permits from May 1971 to February 1973. In February 1973, the Secretary announced a short-term leasing policy to maintain existing mines and to supply reserves for production in the near future. As of March 1978 Interior had issued 11 leases under the short-term policy.

On January 26, 1976, the Secretary of the Interior announced a new Federal coal leasing policy. The new program included:

- A system of nominations through which industry, State and local governments, environmental groups, and the public at large have the opportunity to identify areas that should or should not be leased.
- A totally competitive leasing system, except for existing preference right lease applications.
- A system to determine the economic value of coal areas suitable for leasing.
- A definition of the requirements and time frames for diligent development, continued operations, and advance royalties.

On July 25, 1977, the Secretary stated that the entire coal leasing system would be reviewed. The major purpose of the review is to study the environmental impact of the new coal leasing policies.

On September 27, 1977, the U.S. district court for the District of Columbia ruled, in NRDC v. Hughes, that Interior failed to comply with the National Environmental Policy Act in its 1975 environmental impact statement on Federal coal leasing. The court ordered Interior not to issue any coal leases unless a lease is required to maintain an existing mining operation at present levels or is needed to provide reserves for existing contracts over the next 3 years.

SCOPE OF REVIEW

The Chairmen, Senate Committee on Energy and Natural Resources, and Subcommittee on Public Lands and Resources, requested that we review the reserve estimates and

production projections of Interior and the leaseholders. We were requested to use our authority granted under Title V of the Energy Policy and Conservation Act (42 U.S.C. 6201) to examine the leaseholders' records.

We selected the top 20 leaseholders based on estimated recoverable reserves from an Interior record of coal reserves on Federal leases. Appendix IV shows which leaseholders were selected. These leaseholders controlled about 75 percent of the total estimated recoverable reserves on Federal leases as of September 1976 and included 219 of the then-537 outstanding Federal leases. We also selected all 54 PRLAs held by the 20 leaseholders.

We made our review at the 20 leaseholders located in 12 States; the Geological Survey Regional Conservation Division in Denver, Colorado; and at Survey area and district offices in Denver, Colorado; Salt Lake City, Utah; Billings, Montana; Rock Springs, Wyoming; Carlsbad, New Mexico; Palo Alto, California; and McAlester, Oklahoma.

We interviewed agency officials at Survey area and district offices and reviewed selected available documentation, including reports, maps, and data files supporting Survey's reserve estimates for the selected leases. We also determined what estimating criteria and methodologies were used in computing the estimates.

The Survey estimates were compared with those used by the 20 leaseholders after examining the leaseholders' supporting documentation and estimating methodologies. With assistance from a geologist consultant, we also independently computed reserve estimates on four leases and compared our estimate to Survey and the leaseholders'. We based our estimate on geologic information from Survey and leaseholders' files; also, we used technical and drilling reports purchased from private data service companies.

In computing reserve estimates, we used the criteria and methodology outlined in the 1976 Geological Survey Bulletin No. 1450-B, "Coal Resource Classification System of the U.S. Bureau of Mines and U.S. Geological Survey." These criteria are based on a system in which coal beds are classified by their degree of geologic identification and the economic and technological feasibility of recovery. For example, bituminous coal reserves with the highest degree of identification and recovery feasibility are those coal beds that are 28 inches thick or more, occur at depths

to 1,000 feet or less, and are estimated to exist within 1/4 mile of the point of observation or measurement. (See app. III.)

In determining past, planned, and committed production on the 219 selected leases, we interviewed knowledgeable officials and reviewed available documentation at Survey and leaseholders' offices. Contracts between leaseholders and coal customers were reviewed to verify committed production.

We also reviewed legislation, regulations, policies, procedures, and practices pertaining to leasing Federal coal on public lands.

CHAPTER 2

AN ACCURATE AND RELIABLE RECOVERABLE RESERVE ESTIMATE FOR FEDERAL COAL DOES NOT EXIST

Accurate and reliable recoverable reserve estimates on existing leases are essential for Interior to effectively manage Federal coal--particularly under the new leasing program. However, neither Interior nor leaseholder estimates of recoverable coal reserves for Federal leases and PRLAs can be considered accurate or reliable for use in managing the Federal coal leasing program. The recoverable reserve estimates computed by leaseholders appear to have been better supported by geologic evidence and to have used a more complex estimating methodology. However, many leaseholder estimates are incomplete because they do not consider all coal in computing recoverable reserves. Interior computed recoverable reserve estimates without considering all the geologic evidence available, reportedly because of staff shortages and the short time allowed for computing the reserve estimates.

Unless corrected, these reserve estimate errors may cost the taxpayer because production requirements for diligent development and the continued lease operation, in addition to the assessment of advance royalties, will be based on established percentages of these reserve estimates. Accurate and legal production levels that would protect the interests of the Government, leaseholders, and the public, can only be determined if accurate and reliable reserve estimates are available.

Accurate and reliable reserve estimates are also an important factor in determining (1) the contribution existing leases will make to the Nation's future coal production goals and (2) the need for, and extent of, additional leasing.

As of December 1976 Interior estimated that 537 leases contained 17.3 billion tons of recoverable coal--11.5 billion tons of surface-minable coal and 5.8 billion tons of underground coal. In addition, Interior estimated in March 1976 that 192 PRLAs contained 9.3 billion tons of recoverable coal--6.4 billion tons of surface minable coal and 2.9 billion tons of underground coal.

Survey and leaseholders total recoverable coal estimates for the 219 leases included in our review varied by 22 percent overall, as shown in the following table. Variances on individual leases, however, were much greater.

Recoverable reserve estimates for Federal leases
(in millions of tons)

	<u>Surface coal</u>	<u>Underground coal</u>	<u>Total coal</u>
Survey	9,253	3,533	12,786
Leaseholders	8,101	2,416	10,517
Percent Survey estimate higher than leaseholders	14	46	22

WIDE VARIATIONS EXIST BETWEEN SURVEY AND
LEASEHOLDER ESTIMATES ON INDIVIDUAL LEASES

Survey and leaseholder estimates varied by over 100 percent with some leases. Variations were due primarily to differences in estimating methodology and because Survey considered underground coal in its estimates when some leaseholders did not.

Neither Survey nor the leaseholders had recoverable reserve estimates for all 219 leases included in our review. Survey had estimates for 214 leases while the leaseholders had estimates for 185 leases. Because of the various methods Survey and leaseholders used in computing their estimates, we could only directly compare estimates made on 114 of the leases.

For the remaining 105 leases, either no comparison or only a partial comparison of recoverable reserve estimates could be made. The primary reasons that comparisons could not be made were:

- Survey recognized recoverable reserves, but the leaseholders did not.
- Survey considered both surface and underground reserves while the leaseholders considered only one type of reserve.
- Survey computed reserves on individual leases while the leaseholders' reserve estimates were for a combination of leases.

Of the 114 estimates we compared, Survey estimates varied from the leaseholders by more than 20 percent for over half the leases. The percent and tonnage that Survey estimates varied from the leaseholders are shown in the following table.

<u>Percent variance</u>	<u>No. of leases with Survey's estimates higher</u>	<u>Survey's tonnage higher (millions of tons)</u>	<u>No. of leases with Survey's estimates lower</u>	<u>Survey's tonnage lower (millions of tons)</u>
0-20	23	260	19	190
21-40	9	181	18	329
41-60	5	56	10	344
61-80	4	501	3	89
81-100	2	7	0	0
over 100	<u>21</u>	<u>351</u>	<u>0</u>	<u>0</u>
Total	<u>64</u>	<u>1,356</u>	<u>50</u>	<u>952</u>

Differences in methodology and analysis in computing recoverable reserve estimates

Survey and the leaseholders used the same basic geologic data to compute recoverable reserve estimates. However, different methodologies and differing degrees of analysis were used among the leaseholders and between the leaseholders and Survey. As a result, significant differences occurred on reserve estimates for individual leases. Most basic geologic data such as drill logs, quality analysis, exploration plans, and maps originate with the leaseholder and are submitted to Survey in compliance with the lease requirements. We found no instances where leaseholders had not submitted the required data.

Leaseholders are not required to report their computed reserve estimates for Federal leases. While mining plans do contain reserve estimates, these estimates relate to a proposed mine and the reserves that a company plans to mine. These reserves may consist of Federal and non-Federal coal. The Coal Mining Operating Regulations do not require that the estimate be broken out by Federal lease. We reviewed mining plans, where available, for the 20 leaseholders in our review and were unable to compare leaseholder estimates to Survey estimates for numerous reasons, including the fact that the mining plan estimate encompassed more than Federal coal.

The starting point for computing a reserve estimate is to determine the amount of inplace coal. (See app. III for Survey coal classification criteria.) Drill logs show the thickness of the coal; coal acres can be determined by plotting the drill log locations on a map. Quality analyses show the coal's density. Inplace reserves are determined by multiplying the coal thickness, area, and density. The accuracy and reliability of any inplace estimate is a function of the amount of drilling completed on the leased areas and the distance between the drill holes and other exposures (such as outcrops). Generally, a drilling program with quarter-mile spacing will provide a much more accurate and reliable estimate than a program with 2-mile spacing.

Recoverable reserves are determined by applying a recovery factor to the inplace reserves. The recovery factor should account for economics, mining methods, depth of coal, and other considerations.

In 1973, the Survey Director required Survey field offices to compute reserve estimates on all Federal leases. Survey had a standard estimating methodology at that time that required that inplace reserves be calculated by a reliability category based on the distance between points of observation such as outcrops, trenches, mine workings, and drill holes. The criteria required that inplace reserves be discounted for workability factors based on current technology, safety, and economics in order to determine recoverable reserves.

In computing the 1973 estimates, Survey offices did not use these criteria. According to Survey officials, they were given only 30 days to compute the estimates and could only scan the geologic data contained in their files. Most estimates were determined by the judgment of individual mining supervisors and their staffs rather than on a detailed analysis of all available geologic data.

On one lease, judgments were made without any geologic support. The drill logs indicated the existence of only surface coal; the Survey mining supervisor said that he just assumed there was underground coal somewhere on the lease.

In a few cases, the Survey geologist prepared detailed geologic reports which were used in making the estimate. In most cases, however, we could not determine what geologic evidence Survey considered in estimating the reserves because supporting work sheets were not retained in the files.

In some cases, Survey simply asked for and used leaseholder's recoverable reserve estimates. In one such case, the leaseholder responded with a recoverable reserve estimate for the entire mining area, which included a large tract of non-Federal land as well as the Federal lease, resulting in an inflated reserve estimate for the Federal lease.

Survey field officials stated, and we agree, that the estimates should only be considered as rough and conservative approximations of actual reserves. Survey has updated estimates for only 31 of the 219 leases since 1973 even though leaseholders have submitted the results of additional drilling for other leases. The 31 estimates were updated in 1975 and 1976. None of the updated estimates were based on Survey standard estimating criteria.

Even though Survey field offices did not use Survey required criteria for computing reserve estimates they did use some general criteria. Surface coal was considered recoverable to a depth of 150 feet, except for the Powder River Basin where 200 feet was used. Underground coal was considered recoverable to a depth of 2,000 feet. Usually, an average seam thickness was estimated for each coal seam and applied to the estimated coal-bearing acres on the lease.

Recoverable reserves were based primarily on technology in common use in the mining industry. Inplace surface reserves were discounted by 10 to 15 percent to arrive at recoverable surface reserves. Inplace underground reserves were generally discounted 33 to 75 percent to arrive at recoverable underground reserves.

In those instances where leaseholders had computed reserve estimates, the methodology and extent of analysis used in computing the estimates varied among leaseholders. However, the estimates were generally supported by detailed geologic data and were computed with detailed estimating methodologies.

Leaseholders generally used more available data and performed greater indepth analysis than Survey did in computing reserve estimates. Survey computed estimates manually, whereas 8 of the 20 leaseholders reviewed used computer programs in determining reserve estimates. Such programs provide for a more detailed analysis of greater amounts of data.

For example, a leaseholder with computerized procedures made reserve estimates on 15 leases with coal seam thickness and acres of coal computed to 2 decimal places and with the recovery factor computed to 3 decimal places for each section of the lease. The reserves were then compiled for the entire lease. In contrast, Survey estimates on these leases used a coal seam thickness to the nearest foot, the entire lease acres, and, most often, a standard 50-percent recovery factor for underground coal. Survey reserve estimates on these leases varied from 106 percent higher to 62 percent lower than the leaseholder's.

Generally, leaseholders also used more factors than Survey to determine depth and percent of recovery. Some leaseholders used actual mining experience in the area; others specifically identified unminable areas on the lease (such as seam splits, burned coal, right-a-ways, property line buffer zones, and oil and gas wells). The following table shows the range of recovery depth and percent of recovery used by leaseholders and how they differed from those used by Survey:

Surface coal

	<u>Recovery depth</u>	<u>Coal recovery (percent)</u>
Survey	Surface to 200 feet	85-90 of inplace coal
Leaseholders	Surface to 50-750 feet	80-100 of inplace coal

Underground coal

	<u>Recovery depth</u>	<u>Coal recovery (percent)</u>
Survey	From 150 to 2,000 feet	33-75 of inplace coal
Leaseholders	From 300 to 3,000 feet	19-58 of inplace coal

Leaseholders' estimates were generally more current than Survey estimates. For the 20 leaseholders reviewed, 12 made estimates in 1977, 5 in 1976, and 1 in 1974. The two others could not give dates for their reserve estimates but considered them current.

Leaseholders do not recognize underground reserves on all leases

Ten leaseholders with 71 leases did not include underground reserves in their estimates even though their geologic evidence supported the presence of underground coal. Survey

estimates showed approximately 1.1 billion tons of underground recoverable coal on these leases.

Most of these leaseholders recognized the existence of the underground coal, but were operating or planned to operate surface mines for 20 to 40 years and therefore carried no reserve estimates for the underground coal. For their purposes, they do not consider the underground coal to be reserves.

OUR RESERVE ESTIMATES SHOW ADDITIONAL COAL RESERVES EXIST

The recoverable reserve estimates we computed using Survey-published estimating criteria were higher for underground coal because Survey and leaseholders did not include some underground coal seams in their estimates. The same may be true of other leases. However, the extent of omitted coal on other leases and the effect of these omissions on Survey total recoverable reserve estimates of 17.3 billion tons can only be determined by considering all the available geologic evidence for each lease and recomputing each reserve estimate.

While we were in no position to compute reserve estimates for all 219 leases in our review, we did make a detailed analysis and reserve verification on a sample of four leases using Geological Survey bulletin 1450-B estimating criteria. (See app. III.) This bulletin identifies reserves by reliability categories--measured, indicated, or inferred. The calculations for the reliability categories are based on the distance from points of known conformation--such as drill holes, outcrops, or other points of geologic information. One-fourth mile is used for projection of measured categories; three-fourths mile is used for projection of indicated categories; while three miles is used for projection of inferred categories. These criteria include subbituminous coal in seams 5 feet thick or greater to depths of 1,000 feet. Using the geologic evidence in the files of Survey and the leaseholders, technical reports, and drilling reports purchased from a commercial drill log service, we independently computed reserve estimates with the assistance of a consultant geologist.

For our detailed analysis of four leases, we plotted points of geologic observation on coal structure and

isopach 1/ maps. We divided the leases into measured, indicated, and inferred reserves as outlined by bulletin 1450-B. Areas of the lease were planimetered, 2/ work-sheets were prepared showing planimeter readings, number of acres, average seam thickness, and computation of in-place and recoverable tonnage. A consultant geologist compiled geologic reports to identify coal seams and provided recovery factors used to compute recoverable reserves. Appendix I shows the criteria used in determining the various reliability categories.

A summary of Survey, leaseholders', and our reserve estimates for in-place coal is presented below.

	<u>Inplace surface tonnage</u>	<u>Inplace underground tonnage</u>
Survey estimates	2,228,474,000	35,700,000
Leaseholder estimates	1,831,040,937	5,782,600
Our estimates not including additional seams	2,372,815,727	25,227,803
Our estimates including additional seams	2,372,815,727	542,407,678

As shown in the table above, we identified no additional surface seams; however, we identified several additional underground seams. These additional seams are located 400 to 1,000 feet below the surface and contain over 500 million tons of additional underground coal. About 320 million tons is in the inferred coal reliability category, which have been excluded from recoverable reserves. The remaining 195 million tons was reduced based on current technology to a maximum coal seam recovery of 10 feet for each seam to give recoverable reserves of 82 million tons.

In determining recoverable reserves Survey criteria considers mining technology, economics, and safety. We used a recovery factor of 50 percent for underground coal and 90 percent for surface coal to calculate recoverable

1/Isopach map--a map which shows contour lines connecting points of equal seam thickness.

2/Planimetered: when coal acres are estimated by a planimeter.

reserves shown in the table below, unless the leaseholders used a higher recovery factor, in which case we used their recovery factors. In the interest of completing our work as rapidly as possible we made no attempt to evaluate underground seams based on site-specific economic or safety considerations, both of which could affect recoverable tonnage estimates for the four leases. We recognize, however, that such considerations should be part of recoverable reserve estimates for specific leases.

	<u>Recoverable surface tonnage</u>	<u>Recoverable underground tonnage</u>
Survey estimates	1,909,017,000	14,280,000
Leaseholder estimates	1,594,349,600	2,891,300
Our estimates not including additional seams	1,855,443,035	10,240,094
Our estimates including additional seams	1,855,443,035	82,141,998

RECOVERABLE RESERVE ESTIMATES ARE NOT BASED ON COST AND PRICING INFORMATION

Some leaseholder reserve records do not show what part of their recoverable reserves are considered economically recoverable.

Some leaseholders had prepared detailed economic analyses of their uncommitted recoverable reserves; however, one of these leaseholders considered the analyses outdated because of changes in costs and environmental rules and regulations that have occurred since their preparation. This leaseholder did not plan to update the analyses because there was no demand for the coal.

As stated on page 11, Survey based recoverable reserve estimates on technology in common use in the mining industry. Survey 1973 estimating criteria required that economics be considered in determining recoverable reserves but did not specify the types or the source of economic considerations that should be included. Geological Survey Bulletin No. 1450-B, the current estimating criteria, also requires that economics be considered, but again does not specify the type or source of such data.

Under bulletin 1450-B, reserves are defined as that part of the coal resource for which type, quality, and quantity have been reasonably determined and which is deemed to be minable at a profit under existing market conditions. Survey currently has no requirements for nonproducing leaseholders to provide cost and pricing information; producing leaseholders submit selling price information with production royalty reports. Survey also currently requires estimated cost and revenue data from holders of PRLAs in order to determine whether a lease should be awarded.

In addition to estimated revenues, Survey requires holders of PRLAs to submit mine development and operation costs, coal processing costs, and transportation costs. We believe that reporting and disclosure requirements for similar information should be promulgated to apply to all leases to help assure the accuracy and reliability of reserve estimates. Other benefits would flow from such requirements. For example, Survey would also be in a better position to make an equitable determination of production requirements for diligent development and continued operation. On a much broader scale, these economic data would provide Survey a basis for determining whether leaseholders have a need for additional leases or whether they can mine more coal on existing leases at a profit.

RECOVERABLE RESERVE ESTIMATES ON OUTSTANDING PRLAS ARE NOT COMPARABLE

As of March 1976 Interior estimated that 9.3 billion tons of coal existed on 192 PRLAs, consisting of 6.4 billion tons of surface coal and 2.9 billion tons of underground coal. For the 20 leaseholders we reviewed, 7 had 54 PRLAs, and the remaining 13 had none. Survey and leaseholders' estimates differed significantly for underground coal because the leaseholders had made no estimates or only partial estimates for underground coal on some PRLAs. For example, 2 leaseholders had not made any recoverable reserve estimate for 13 of their PRLAs. The Survey recoverable reserve estimate for these 13 PRLAs totaled over 440 million tons of underground coal and over 5 million tons of surface coal. Two other leaseholders with surface estimates had not made recoverable reserve estimates for underground coal on seven of their PRLAs. The Survey underground recoverable reserve estimate was over 38 million tons. The Survey recoverable reserve estimate for all 54 PRLAs is 3 percent higher than leaseholder's estimates for surface coal and 368 percent higher for underground coal, as shown by the table below.

Recoverable Reserve Estimate for 54 PRLAs
(in millions of tons)

	<u>Surface coal</u>	<u>Underground coal</u>	<u>Total coal</u>
Survey	505	1,187	1,692
Leaseholders	492	253	745
Percent Survey estimate higher than leaseholders	3	368	127

In May 1976 Interior issued regulations requiring PRLA holders to demonstrate that expected revenues would exceed the expected cost of mining. No reevaluations have since been made which could take advantage of this additional economic information and perhaps refine Survey estimates.

In July 1977 Interior announced a management review of Federal coal leasing. As part of this review, Interior will determine whether existing leases and preference right lease applications for coal are in areas that can be developed in an environmentally acceptable manner.

Uncertainty exists about whether any or all existing PRLAs will be issued as leases because the administration directed that Interior examine existing leases and PRLAs to determine whether they show prospects for timely development in an environmentally acceptable manner, taking steps as necessary to deal with nonproducing and environmentally unsatisfactory leases and PRLAs. This evaluation has not yet been completed.

In an unrelated action, the Interior solicitor determined that a preference right lease cannot be issued if the coal lands were included in an unpatented mining claim when the applicant obtained a prospecting permit. Consequently, if coal exists in areas where there are prior mining claims, a noncompetitive lease cannot be issued. Any leasing would have to be done on a competitive basis. A preliminary Bureau of Land Management estimate shows that many mining claim conflicts may exist.

DILIGENT DEVELOPMENT, CONTINUED OPERATION, AND
ADVANCE ROYALTY REQUIREMENTS CANNOT BE
EFFECTIVELY OR EQUITABLY APPLIED

Diligent development, continued operation, and advance royalty requirements, which apply to all leases beginning in 1976, cannot be effectively or equitably applied because they will be based on inaccurate or unreliable recoverable reserve estimates. The use of the existing reserve estimates in determining the requirements will result in inequities to the Government and to leaseholders. Production requirements and advance royalty assessments could be overstated as well. Disadvantages to the Government could be the assessment of insufficient advance royalties and misallocation of resources. Disadvantages to the leaseholder could be the possible unnecessary cancellation of either all or part of a lease and assessments of excessive advance royalties.

Explanation of coal production requirements

The Mineral Leasing Act of 1920 (30 U.S.C. 181) required that leaseholders satisfy the conditions of diligent development and continued operation. However, the conditions were not expressly defined in terms of coal production requirements until May 28, 1976, when Interior issued revised leasing regulations which were further amended on December 29, 1976. The diligent development production requirements are different for leases issued before and after August 4, 1976, the definitions discussed below are applicable to only those leases. As of May 1977 only one lease had been issued after August 4, 1976, under the short-term criteria.

The production requirements pertain to logical mining units (LMU) 1/ and are based on a Survey estimate of LMU

1/LMU is defined as an area of coal land that can be developed and mined in an efficient, economical, and orderly manner with due regard to the conservation of coal reserves and other resources. An LMU may consist of one or more Federal leaseholds, and may include intervening or adjacent non-Federal lands, but all lands in an LMU must be contiguous, under the effective control of a single operator, and capable of being developed and operated as a unified operation with complete extraction of the LMU reserves within 40 years from the first approval of a mining plan for that LMU.

recoverable reserves. As of June 30, 1977, Survey considered each of the 219 leases to be an LMU. These LMUs may be expanded to include other Federal leases and non-Federal coal lands with Survey approval.

Diligent development

Diligent development requires that 2-1/2 percent of the LMU recoverable reserves must be produced between June 1, 1976, and June 1, 1986, or 10 years from date of lease whichever is later. If an LMU has not produced coal in sufficient quantities to satisfy this requirement, the Federal lease and leases comprising or included in the LMU will be subject to cancellation in whole or in part.

The Secretary of the Interior may extend the diligent development period under certain prescribed conditions if diligent development cannot be achieved in 10 years. For example, a one-time extension not exceeding 5 years may be granted if a leaseholder has a firm commitment for the sale or use of the first 2-1/2 percent of LMU reserves after the 10-year period. However, the Secretary cannot extend the diligent development period when the following circumstances prevent the development of a lease.

- Circumstances arising out of normally foreseeable costs of compliance with requirements for environmental protection.
- Circumstances arising out of common delays in delivery of supplies and equipment.
- Circumstances arising out of the inability to obtain sufficient sales.

Continued operation and advance royalties

Continued operation requires that a minimum of 1 percent of recoverable reserves must be produced during each of the first 2 years following achievement of diligent development. Thereafter, an average minimum annual rate of 1 percent must be produced. The continued operation requirement may be suspended for not more than 10 years by the payment of advance royalties. The royalties are computed and assessed by a schedule which will eliminate remaining recoverable reserves 40 years from June 1, 1976.

Understated reserve estimates will produce inadequate production requirements

Diligent development and continued operation requirements will be understated on some leases because the reserve estimates are not accurate or reliable. The leaseholders' recoverable reserve estimates for 77 of the 219 leases (35 percent of the leases reviewed) exceed the Survey recoverable reserve estimates by 1.4 billion tons. If the leaseholders' estimates for the 77 leases are more reliable, diligent development requirements based on Survey estimates will be understated by 34 million tons. Likewise, continued operation requirements will be understated by about 14 million tons annually.

Leaseholders presently plan to produce coal on 31 of the 77 leases before 1986. The leaseholders' recoverable reserve estimates exceed Survey recoverable reserve estimates on these leases by about 811 million tons. Consequently, the diligent development and continued operation requirements on the 31 leases will be underestimated by about 20 million tons and 8 million tons, respectively.

On one of the four leases for which we calculated a recoverable reserve estimate, we determined that the Survey estimate was understated by about 96 million tons. This will result in the understatement of diligent development by about 2 million tons and continued operation requirements by about 1 million tons annually. Under present circumstances, these reserve estimates, if used by Interior in applying production requirements, would provide a basis for continuation of a lease, even though production may not satisfy the diligent development of all recoverable reserves. If a lease with understated reserves is continued, recoverable reserves which should be produced may remain in the ground under the leaseholder's control. For example, on 77 leases the leaseholders estimate there are 1.4 billion tons of recoverable coal that are not included in the Survey estimate. Survey will not require production of this coal if its estimate is not revised. It is possible that the leaseholders may produce only the minimum diligent development tonnage required by Survey. If this occurs, the 1.4 billion tons would not be subject to lease production terms and conditions.

In addition to inadequate production requirements, Survey will assess insufficient advance royalty charges on leases which have understated reserve estimates. This

will occur on leases that do not satisfy continued operation requirements.

Overstated reserve estimates will produce excessive production requirements

Diligent development and continued operation requirements will be overstated on leases where Survey recoverable reserve estimates are too high. Survey recoverable reserve estimates for 139 of 219 leases (63 percent of the leases reviewed) exceed the leaseholders' recoverable reserve estimate by 3.6 billion tons. If the leaseholders' estimates for the 139 leases are more reliable, the diligent development and continued operation requirements will be overstated by about 90 million tons and 36 million tons, respectively.

On two of four leases for which we calculated a reserve estimate, we determined that the Survey estimate is overstated by about 170 million tons. This overstatement will result in diligent development and continued operation being overstated by 4.2 million tons and 1.7 million tons, respectively. These production requirements could be considered excessive by the lessee and the lease could be abandoned. In such a case, Interior would be unnecessarily impeding coal development.

Diligent development determinations may be needed before June 1, 1986

Survey has not yet undertaken a study to determine which producing leases have achieved diligent development. This is needed so that Survey can impose continued operation or advance royalty requirements. Diligent development for most of the existing leases can be achieved any time between June 1, 1976, and June 1, 1986. In 1976, 19 leases were producing and there were plans to produce on 57 leases by 1980. Diligent development may be achieved on many of these leases before the June 1, 1986, deadline.

At the time of our review no formal guidance or directive had been provided to field officials on the assessment of diligent development. Two area mining supervisors stated that they had no plans to undertake such studies. Survey Conservation Division officials in the central region planned to recommend to Survey headquarters that area mining supervisors review the reserve estimates on producing leases and determine if diligent development has been achieved on these leases. We do not see how Interior can exercise its legal responsibilities under the law without making the necessary assessments.

CHAPTER 3

PRODUCTION ON FEDERAL COAL LEASES HAS BEEN MINIMAL

Federal leases include a requirement for diligent development; however, no coal had been produced before 1977 on 190 (87 percent) of the 219 leases included in our review. The leases had been held an average of about 7-1/2 years. Leaseholders stated that a lack of demand was a major reason the coal was not produced. Most leases are in various stages of planning for future production because leaseholders now anticipate continued increases in coal demand. Interior estimates show that the 219 leases contain about 75 percent of the recoverable reserves on all 537 Federal coal leases.

Leaseholders plan to produce 212 million tons of coal annually by 1985 on 113 leases, which is about 18 percent of the administration's goal of 1.2 billion tons. About 131 million tons of this planned production from 45 leases is already under contract.

The importance of the planned production from the Federal leases to the Nation's future coal production becomes apparent when it is compared to the increased production necessary to meet the administration's 1985 goal. To meet the administration's goal, the Nation's annual coal production must increase by 528 million tons from the 1977 estimated production of 672 million tons--an increase of about 79 percent. The committed production in 1985 would provide 25 percent of the necessary increase in coal production to meet that goal. By adding the planned production from Federal leases for 1985, they could achieve 40 percent of the necessary increase.

PRODUCTION ON FEDERAL LEASES

Of the 219 leases reviewed, 29 leases held by 10 leaseholders had produced 107.1 million tons of coal through 1976. In 1976, 19 leases held by 8 leaseholders produced 18.7 million tons. This represents 48 percent of total Federal production but only 3 percent of the Nation's coal production.

Planned and committed production

When we visited leaseholders, 15 had developed mining plans for 118 of the 219 leases reviewed. Production by 1985 is planned for 113 of these 118 leases. Mining plans

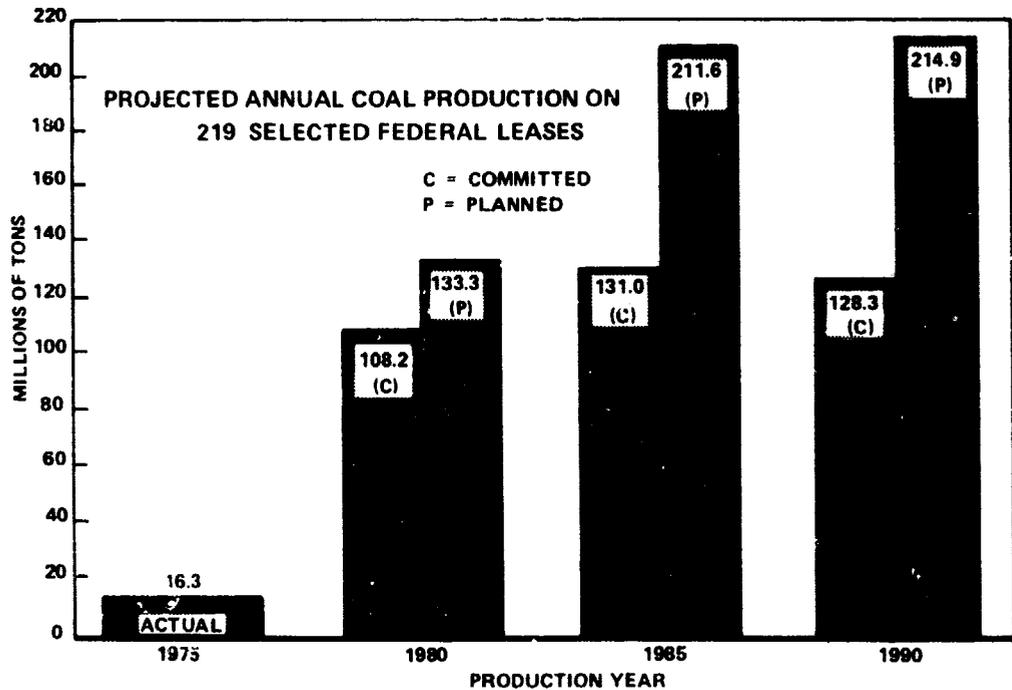
have been approved by Survey for 31 of the 118 leases, and mining plans for the remaining 87 leases are pending Survey approval.

Planned production from the 118 leases totals about 7.1 billion tons (3.6 billion tons from 31 leases with approved mining plans and 3.5 billion tons from 87 leases with mining plans pending approval). This is almost all of the recoverable reserves contained on the leases as estimated by the leaseholders.

Some of the planned production included in mining plans is not contractually committed, and it is not possible to determine if or when the coal will be mined. Out of the 3.6 billion tons of planned production for the 31 leases, 2.3 billion tons are committed. Of the 3.5 billion tons of planned production for the 87 leases, 1.3 billion tons are committed. The coal cannot be mined from the 87 leases, however, until the mining plans are approved by Survey.

Leaseholders stated that mining plans were often submitted for uncommitted production in anticipation that a customer for the coal could be found by the time the plan and environmental impact statement are approved.

The following graph compares 1975 production on the reviewed leases with planned and committed production on those leases with submitted mining plans for 1980, 1985, and 1990.



PERCENT INCREASE
(DECREASE) FROM
5 YEARS EARLIER:

	1975	1980	1985	1990
COMMITTED	--	564%	21%	(2%)
PLANNED	--	718%	59%	2%

In 1975, most of the coal produced from the reviewed Federal leases was in Montana. In 1976 most of the production came from Wyoming, and most of the planned and committed production by 15 leaseholders is to be in Wyoming after 1976.

Most committed coal production is to be utilized by out-of-State electric power generating plants

Of the 3.6 billion tons of coal production committed by 12 Federal leaseholders, 84 percent is to be consumed in electric power generating plants. Two billion tons (about 60 percent) are to be transported to out-of-State electric power generating plants and about 870 million tons are committed to in-State power plants. However, electric power generated from these plants may go out-of-State.

Mining plans are required of Federal coal leaseholders

Since early 1969 Interior has required leaseholders to submit mining plans before developing coal on any Federal lease. These plans are to show the extent and method of proposed operation and to describe the actions to be taken to protect the environment. Also, the mining plan is used to describe reclamation techniques and measures that the leaseholder will take to protect the environment. Operators are required to file a mining plan with Survey and to obtain approval of the plan before starting operations.

The procedures for Interior approval of mining plans have evolved into a lengthy process. At two Survey offices, mining plans that we reviewed averaged 21 months from the date the leaseholder submitted the plan. The area mining supervisors stated that they now expect those plans (pending approval) to take an average of 31 months from submission. The necessity for Survey to prepare environmental impact statements can delay the approval of mining plans. For example, a mining plan dated March 1975 was to have had the necessary statement completed in March 1977, about 2 years after the decision was made to prepare the statement. In August 1977 Survey estimated completion of the statement to be the spring of 1978.

STATUS OF LEASES FOR WHICH MINING PLANS HAVE NOT BEEN PREPARED

Of the 219 Federal coal leases reviewed, mining plans for 101 had not been submitted for Survey approval. Estimates by leaseholders show that the 101 leases contain 3.4 billion tons of recoverable coal--about 32 percent of the estimated 10.6 billion tons of recoverable coal on the 219 Federal leases.

The following table outlines the primary reasons why lessees claim that mining plans have not been prepared.

Primary reason leases not included in mining plan	Number of leases	Number of leaseholders	Avg. yrs. leases held by current leaseholders	Leaseholder estimated recoverable reserves	
				Millions of tons	Percent of total
Leases still under exploration	38	5	8.5	1,831.3	55.3
Unsuccessful attempts to market the coal	17	4	8.1	453.4	13.7
Coal being held as inventory for internal use	15	2	13.8	613.4	18.5
Insufficient reserves to be marketable	9	2	9.4	34.0	1.0
Lease assigned or under option	9	2	8.5	37.5	1.1
No current marketing attempts by leaseholder	5	2	10.2	50.1	1.5
Mining plan under consideration by leaseholder	3	2	9.6	11.7	0.4
Lease considered mined out by leaseholder	3	2	28.4	0	-
Surface rights not acquired by leaseholder	<u>2</u>	<u>2</u>	<u>6.6</u>	<u>283.1</u>	<u>8.5</u>
Total	<u>101</u>	<u>a/23</u>	<u>10.0</u>	<u>3,314.5</u>	<u>100.0</u>

a/Twelve of the 20 leaseholders had leases without mining plans, and some leaseholders had more than one reason for no planned production.

On one hand, the lessee's reasons why coal is not being produced appear to be fallacious. On the other hand, because the lessees pay to retain the leases is prima facie evidence that leases are valuable and explains why Survey should be especially diligent in analyzing the coal reserves that may be present.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

In a previous report 1/ on the Federal coal leasing program, we stated that Interior should have as clear a conception as possible of the potential contribution of Federal lands toward meeting the national coal production goal. We concluded that the estimates on existing leases did not provide a sound basis for forecasting production potential. That conclusion has not changed. This report concludes that Survey reserve estimates are not accurate or reliable.

Accurate and reliable reserve estimates are needed not only to comply with the law but also to make sound management decisions on the need for, and the extent of, additional leases. To comply with the law, accurate and reliable reserve estimates take on absolute importance in view of the diligent development, continued operation, and advance royalty requirements. Timing is also important because some of the 537 outstanding leases will require diligent development determinations before June 1, 1986.

Prior GAO reports 1,2/ have referred to the need for production requirements to encourage the development of Federal coal leases and reduce the opportunity for speculative holding. The Federal Coal Leasing Amendments Act of 1975 also contains diligent development and continued operation requirements. We believe these requirements will contribute significantly to resolving this problem, since the law requires production and continued operation by 1986 on all existing leases and provides for cancellation of the lease if production requirements are not met. The continued operation requirement may be suspended for not more than 10 years by the payment of advance royalties. Unfortunately, the new diligent development and continued operation requirements will not be effectively or equitably applied because the

1/"Role of Federal Coal Resources In Meeting National Energy Goals Needs To Be Determined And The Leasing Process Improved," REL-76-79, April 1, 1976.

2/"Further Action Needed On Recommendations For Improving The Administration of Federal Coal-Leasing Program," RED-75-346, April 28, 1975.

reserve estimates are not accurate or reliable. Because of this, requirements will be overstated in some instances and understated in others, and Interior would mismanage Federal resources. Survey reliance on understated reserve estimates in enforcing the requirements would cause inadequate production controls and could increase the opportunities for speculative holdings. Advance royalty payments could be excessive or insufficient.

Survey does not include all coal resources underlying a lease--even according to its own criteria. Furthermore, Survey recoverable reserve estimates are based on general recovery factors and not on detailed current economic analyses--thus allowing for unreliable estimates. This situation exists even though Survey estimating criteria require that economics be considered in determining recoverable reserves. Survey is currently receiving estimated cost and revenue data from PRLA holders to determine whether a lease should be awarded. Reporting requirements for similar information should be promulgated to apply to all leases to help Survey assure the accuracy and reliability of reserve estimates.

Survey field offices were directed to compute reserve estimates on all Federal leases in 1973. Reportedly because of time constraints, most of the estimates were based on the judgment of the mining supervisors after they quickly scanned the geologic data contained in their files. Survey field officials indicate, and we agree, that these estimates should be considered only as rough and conservative approximations of actual reserves. Only 31 of 219 leases reviewed had been updated since 1973; however, none of these were based on Geological Survey Bulletin No. 1450-B. If Survey followed a uniform basis for estimating reserves such as outlined in bulletin 1450-B, we believe that the reliability of the estimates would increase.

Survey estimates were computed manually. Many leaseholders used more of the available data and performed more complex analyses with the aid of computer programs than did Survey. A computer capability for Survey can provide for a more detailed analysis of greater amounts of data and produce more precise and accurate estimates.

A methodology for computing reserve estimates within the Government has been agreed to between the Bureau of Mines and the Geological Survey; however, industry does not use the same methodology. Leaseholders use different

methodologies and parameters in computing recoverable reserve estimates. We believe Interior should publish regulations for comment and hold public hearings so that a standard methodology can be developed and understood between industry and Government. Such a standard methodology will enable industry and Government to make meaningful analyses and comparisons.

RECOMMENDATIONS

The Secretary of the Interior, in cooperation with the Secretary of Energy, must improve the accuracy of reserve estimates. We recommend that the Secretary of Interior:

- Publish reserve estimate methodology regulations for comment and hold public hearings so that a standard methodology can be developed and understood between industry and Government.
- As an interim measure, require Survey to use the published estimating criteria contained in Geological Survey Bulletin No. 1450-B for determining estimates and review and update all reserve estimates on existing leases. First priority should be given to producing leases and leases scheduled to come into production within the next 5 years to assure that the diligent development, continued operation, and advance royalty provisions will be accurately assessed. When diligent development or continued operation requirements are not met by the lessees, as required by law, the leases should be terminated.
- Obtain from leaseholders reserve estimates, cost, and pricing data and develop procedures for analyzing this information in estimating recoverable reserves.
- Consider acquiring a computer capability to provide for more effective and timely determination of reserve estimates.

CHAPTER 5

AGENCY COMMENTS

Comments on a draft of this report were solicited from the Departments of Energy and the Interior. Comments were received from the Department of Energy and from the following offices of Interior:

U.S. Geological Survey,
Bureau of Mines, and
Office of Minerals Policy and Research Analysis.

Specific comments from the Department of Energy and each Interior office are included as appendixes I and II.

COMMENTS BY THE DEPARTMENT OF ENERGY

Energy agreed with the recommendations and wanted them expanded to include responsibilities of the Department of Energy. (See app. I.) Energy correctly noted that the Secretary of Energy, under the Department of Energy Organization Act, has certain responsibilities with energy production from Federal leases. The Act also requires that the Secretaries of the Departments of the Interior and Energy cooperate in developing programs on Federal leases. Energy suggested that data collection, development, and publication efforts in which Interior is involved be undertaken cooperatively by both Departments to avoid duplication and assure the establishment of unified data development criteria. Energy stated that implementation of our four recommendations on the Federal coal leasing program should require the involvement of both Interior and Energy. We agree with this position, and we recommend that the Secretary of the Interior cooperate with the Secretary of Energy to take steps to improve the accuracy of coal reserve estimates.

COMMENTS BY THE DEPARTMENT OF THE INTERIOR

Three separate Interior offices commented on our draft report. (See app. II.) Several inconsistencies existed in the detailed comments and there was no indication about which comments represent the official Interior position. The substantive comments of all three offices are discussed below.

Geological Survey

Survey raised a variety of objections to our report. It first objected to the use of the term "inaccurate" when referring to Survey's estimated reserve value. Survey stated that the term "inaccurate" presumes the existence of a correct value, but this does not exist for coal estimates. Survey said that when discussing reserve estimates attention should be focused on the methodology and the assumptions used in the determination rather than on the estimated value.

We believe our use of the term "inaccurate" is appropriate because there is every reason to believe that Survey estimates do not approach what would be a correct value. At the same time, we agree that the methodology used to determine a reserve estimate is crucial. Our first recommendation relates to the development of a standard methodology which does not now exist between industry and Government. Furthermore, although Survey had a standard estimating methodology when it prepared its coal estimates in 1973, the methodology was not adequately used. There certainly is no evidence that up-to-date economic techniques were used. The estimates were based on the quick judgments of mining supervisors.

Survey stated that we placed strong emphasis in the report on the use of a gross reserve figure for managing the coal leasing program. We disagree with this statement. As clearly indicated on page 5 and throughout chapter 2, we reviewed 219 individual Federal leases held by 20 leaseholders and compared reserve estimates on individual leases for 114 of these leases. The table on page 9 shows that Survey estimates varied from the leaseholders' by more than 20 percent for over half of these leases. Based on these inconsistencies, we do not believe that the diligent development, continued operation, and advance royalty requirements of the law, which are to be applied on individual leases, can be accurately assessed.

Survey also stated that many coal leases contain insufficient reserves to be considered economic mining units. We disagree with this statement. The results of our review of the Federal lease records for the 20 largest leaseholders and discussions with their officials showed that only 9 of the 219 leases reviewed contained insufficient reserves to be marketable. (See p. 26.)

Survey also stated that existing regulations, procedures, and a new program authorized for reserve calculations precluded inequities to anyone. We disagree with this statement. Diligent development, continued operations, and advance royalty requirements of the law will be based on a percent of the recoverable reserves. We believe that the possibility of inequitable application of these requirements is great. As demonstrated throughout this report, Survey reserve estimates were determined by the judgment of mining supervisors without the use of a standard estimating methodology. Leaseholder reserve estimates for individual leases in many cases differed sharply from Survey.

We believe that the new Survey program to institute a systematic program for estimating coal reserves on Federal leases--initially funded for \$1 million in fiscal year 1979--is a step in the right direction. We did not evaluate this program since it was not operational during our review. However, we believe it is unlikely that the accuracy or reliability of reserve estimates will be substantially improved unless Survey makes a concerted effort to develop standard, current, economic and technical techniques that protect the public interest to the fullest extent.

In addition to the above general comments on our draft report, Survey had 20 specific comments. (See pp. 40 to 43.) We considered each comment carefully in preparing our final report and made revisions as appropriate.

Bureau of Mines

The Bureau stated that the report apparently used the terms "resources" and "reserves" interchangeably. This is not the case. The report used the term "reserves" as defined in Geological Survey Bulletin No. 1450-B, which describes the Interior coal classification system. (See our glossary.) The bulletin identifies reserves by reliability categories--measured, indicated, or inferred.

The Bureau also stated that it disagrees with the draft report inference that the Federal Government would be damaged by failure to know the exact tonnage for diligent development and continuous operation. Our report clearly states that to comply with the law accurate and complete reserve estimates take on absolute importance in view of the diligent development, continued operation, and advance royalty requirements. We believe that these requirements can contribute significantly to encouraging

the development of Federal coal leases and reducing the opportunity for speculative holding and, therefore, are in the public interest. However, if Interior uses existing reserve estimates to enforce the requirements, the effective and equitable application of these requirements could be impaired. Interior reliance on inaccurate and unreliable reserve estimates in enforcing the requirements would produce inadequate production controls, increase the opportunities for speculative holdings, and not be in the public interest.

Office of Minerals Policy and Research Analysis

The Office generally agrees that the basic points made in the draft are valid and deserve Survey attention.

However, the Office stated that the draft lacked any idea of cost effectiveness to improve the available information or to change the data system. The Office further implied that cost effectiveness should be estimated before any accuracy goals are set. The Federal Coal Leasing Amendments Act of 1975 directed the Secretary of the Interior to conduct a comprehensive exploratory drilling program. One purpose of that program was to estimate the amount of coal that is recoverable by deep mining operations and the amount of such coal which is recoverable by surface mining operations. Also, minimum production levels for the diligent development and continued operation requirements of the Act are based on a percent of recoverable reserves. To comply with the law and effectively manage the coal leasing program, accurate and reliable reserve estimates are therefore essential.

Concerning the cost effectiveness of a comprehensive exploratory drilling program, the cost to the Federal Government cannot be determined until Interior develops a resource appraisal plan and identifies the levels of drilling needed to assess major coal areas. It should be the business of Interior to make such assessments--including a cost-benefit analysis. The fact that Interior has not chosen to do so in no way negates our argument that such a program might not benefit the public interest.

In addition to the above general comments, the Office of Minerals Policy and Research Analysis had five specific comments. (See pp. 45 and 46.) We considered each comment carefully in preparing our final report and made appropriate revisions.



Department of Energy
Washington, D.C. 20545

FEB 3 1978

Mr. Monte Canfield, Jr., Director
Energy and Minerals Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Canfield:

We appreciate the opportunity to review your draft report entitled "A Study of Western Coal Under Federal Lease--Reserves and Production." As discussed with Mr. Kevin Boland and Mr. Vincent Arostegui of your staff on February 3, 1978, we offer the following comments for your consideration in finalizing the report.

In general, we agree that the four recommendations contained in the report need to be accomplished. However, the Secretary of the Department of Energy (DOE) under the DOE Act, has certain responsibilities relative to energy production (coal, oil and natural gas) from Federal leases. The DOE Act also requires that the Secretaries of the Department of the Interior (DOI) and the DOE cooperate and develop programs relating to Federal leases. Therefore, to implement the four recommendations relating to the Federal Coal Leasing Program should require the involvement of both DOI and DOE (not just the DOI, as specified in the recommendations of this report).

As you are aware, the DOE also has responsibility under the authority of the Department of Energy Organization Act (42 U.S.C. 7101) to disseminate information and data pertaining to coal reserve estimates. Where data are found to be lacking, DOE has mandatory authority to collect any coal and/or coal-related data that the Federal Government may need to satisfy its legal obligations. This involves DOE in the cooperative efforts of the two Departments.

We suggest that data collection, development and publication efforts in which DOI is involved, be undertaken cooperatively by DOI and DOE to avoid duplication and to ensure the establishment of unified data development criteria. Data collected in such a cooperative environment could be made available to all parties concerned in the Federal and State Governments as well as to those in the private sector.

As discussed with Mr. Boland and Mr. Arostegui, there are several statements in the draft regarding the justification of need by nominators of additional reserves and the termination of leases for lack of diligent development

FEB 6 1978

Mr. Monte Canfield, Jr.

which give us some concern. It should be understood that any nominator must by law justify his need for additional reserves and must bid competitively for any Federal coal reserves. Furthermore, the Federal Coal Leasing Amendments Act of 1975, Section 3(2)(A), states that any lessee holding a Federal coal lease that is not producing in commercial quantities within ten years after enactment of the Coal Lease Amendments Act of 1975 will not be entitled to an additional Federal coal lease. Therefore, with the requirement for diligent development, the fact that leaseholders of non-producing leases may nominate additional areas appears to be an irrelevant issue. Since he must not only justify his need for additional reserves and bid competitively, but will not be entitled to an additional Federal coal lease because he already holds a non-producing lease, barring him from nominating additional areas would appear to be unnecessary.

Similarly, since termination of a lease is required by existing law when diligent development or continued operation requirements are not being met by the lessees, there appears to be no need to repeat this requirement as part of the second recommendation on page 46.

We also discussed the need for uniform definitions of such terms as "total reserves," "recoverable reserves," and "economically recoverable reserves." We would be pleased to furnish assistance and cooperate with DOI in developing such definitions for use in developing information and data pertaining to coal reserve estimates.

In conclusion, I hope that these comments will prove to be useful and that you will not hesitate to contact me if I may be of further assistance. I can assure you that DOE is prepared to assist DOI in the development of coal methodology or additional data, should we be requested to do so.

Sincerely,



Fred L. Miser, Director
Division of GAO Liaison



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JAN 30 1978

Mr. Monte Canfield, Jr.
Director, Energy and Minerals Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Canfield:

The Assistant Secretary--Energy and Minerals has provided the enclosed comments on the draft report "A Study of Western Coal Under Federal Lease--Reserves and Production" from the U.S. Geological Survey, the Bureau of Mines, and the Office of Minerals Policy and Research Analysis.

Three of the four recommendations made by GAO are responded to by Geological Survey in its Specific Comments under "Digest". The first recommendation is a matter for further discussion and a policy decision.

Sincerely,

Larry E. Meierotto
Deputy Assistant Secretary
Policy, Budget, and Administration

Attachments

U.S. Geological Survey

COMMENTS ON GAO DRAFT REPORT

**"A Study of Western Coal
Under Federal Lease--Reserves and Production"**

The Geological Survey through its Conservation Division has two programs which specifically address the question raised on the need for coal reserve data. The first of these programs is a basic data compilation effort initiated in FY '77. One of the end product maps of this program, referred to as a Coal Resource Occurrence (CRO) map, will provide a bed-by-bed analysis of coal reserves for unleased federally owned coal reported on a section-by-section basis. The calculation of reserves will be based on criteria as set forth in USGS Bulletin 1450-B. Annual production of 1:24,000 scale quadrangle maps from this program is projected to average 210 per year. Eventual coverage may reach 1300 quadrangles to cover the major U.S. coal basins containing significant Federal coal lands.

A second program will receive initial funding in FY '79 of \$1 million. These funds will be used to institute a full scale systematic program for estimating coal reserves on Federal leases. The 537 Federal coal leases will receive a high priority. All outstanding leases would be reviewed, and reserve estimates would be revised by 1983 in order to establish diligence, continuous operation, and advance royalty requirements.

GAO frequently uses the term "inaccurate" when referring to the Geological Survey's estimated reserve values. The use of the term "inaccurate" presumes the existence of a correct value on which to base this judgment.

It must be noted that no such "correct value" exists. The reserve estimate is in the final analysis an expression of judgment. In addition to the obvious physical uncertainties inherent in quantifying the dimensions of the resource, reserves by definition are determined on the basis of an array of economic and technological assumptions which are subjectively selected and which are also accompanied by considerable uncertainty. This is not to say that reserves cannot be estimated, but that such estimates are at best uncertain and must be understood and used as such. Competent reserve estimation minimizes this uncertainty to the practical limit. The "accuracy" of reserve estimates can be assessed only when the last ton has been produced. The validity of the reserve estimate can be appropriately audited when attention is focused on the methodology and the assumptions used in the determination rather than on the bottom-line estimated value.

On several occasions during the past year, GAO officials have testified at Congressional hearings and cast doubt on Geological Survey estimates of Federal coal reserves under lease. As GAO has pointed out with this report, the Survey's estimates were prepared for all coal leases over a 30-day period in 1973. In addition, the estimates were based on long-established mineral leasing workability concepts rather than the criteria established in a 1976 USGS Bulletin.

Now, after GAO has spent 1 year analyzing less than one-half of the leases with the aid of a geological consultant and after purchasing additional private data, they have confirmed, in our view, the "gross" reserve estimate the Survey provided the Department on extremely short notice in 1973. The report fails to note this achievement.

GAO has placed strong emphasis in this report on the use of a "gross" reserve figure for managing the Department's coal leasing program and fails to recognize other important factors. Many coal leases contain insufficient reserves to be considered economic mining units. Lessees must acquire additional Federal or private lands adjacent to the lease to control a viable unit for mining. The Surface Mining Control and Reclamation Act of 1977 requires the States and the Secretary to institute programs (as yet undefined) for designating lands unsuitable for mining. These factors would influence the availability of coal reserves under lease and the need for a leasing program.

John O'Leary (Department of Energy) has testified that perhaps only one-fourth of Federal coal reserves under lease are actually available for mining in his judgment.

GAO is concerned that use of the Survey's existing reserve estimates would result in inequities to the Government and leaseholders with respect to diligent development, continued operations, and advance royalty requirements. We believe that existing regulations, procedures, and a new program authorized for reserve calculations preclude inequities to anyone.

GAO has criticized the length of time required to approve a mining plan. The National Environmental Policy Act of 1969 (NEPA) requires that all Federal Agencies prepare an Environmental Impact Statement (EIS) for each major Federal action significantly affecting the human environment before that action may be taken. Through provisions of the Mineral Leasing Act of 1920 and the Federal Coal Leasing Amendments Act of 1975, the Secretary of the Interior (and, as delegated by him, the Geological Survey) is responsible for supervision of mining

operations on Federal mineral leases. Under current regulations, before mining operations can commence on a Federal lease or before an existing mining operation on a Federal lease can undergo a major revision, a mining and reclamation plan must be received and approved. Such approvals have been determined to be normally major Federal actions within the meaning of NEPA, thereby requiring preparation of an EIS.

Based on the Survey's experience in preparing site-specific EIS's on proposed mining and reclamation plans, approximately 15 months are required to complete the EIS process--assuming that events beyond the control of the Survey do not cause delays. In the case of several site-specific EIS's prepared by the Survey in recent years, several factors have combined to prolong the completion time:

- (1) Since 1976, the 30 CFR 211 regulations which govern coal mining operations have been revised twice. These revisions have caused delays in EIS preparation while new implementing procedures were developed. Further delays in EIS completion are anticipated resulting from the enactment of the Surface Mining Control and Reclamation Act of 1977, changes in Federal coal leasing policy, and changes in the draft Council of Environmental Quality (CEQ) regulations for EIS preparation.
- (2) During the past three years, one applicant has revised its submitted mining and reclamation plan three times, requiring major revision of the Preliminary Draft Environmental Statement (PDES) that had already been prepared, and delaying completion of the EIS approximately two years. Another applicant made a major revision in the location of its surface facilities after the PDES had already been prepared causing a six month delay while the applicant revised its mining and reclamation plan.
- (3) Substantial delays have resulted when the Survey has had to begin evaluation of incomplete mining and reclamation plans. One plan was deficient in its soil analysis, another was deficient in its hydrologic analysis, while a third included mining a parcel of unleased Federal coal.

SPECIFIC COMMENTSDIGEST

Page V, last paragraph - Nonproduction may be the result of incomplete holdings to make an LMU or the subeconomic quality of coal contained in a PRL.

Page Vi - Recommendation 2, 1450-B, is presently being reviewed for revisions. By memorandum dated November 14, 1977, from the Chief, Conservation Division, Mining Supervisors were instructed to update reserve estimates on producing leases for the purpose of assuring proper diligent development, continued operations, and advance royalty payments.

Page Vi - Recommendation 3 is already a general requirement in filing of mining plans and commercial quantities regulations.

Page Vi - Recommendation 4 - Computer systems for reserve estimates are presently under consideration for acquisition.

Glossary - Suggest revision of the definition of inferred resources to coincide with that in Bulletin 1450-A. Also, why are identified, indicated, inferred, measured, subeconomic, and undiscovered only defined for resources and not for reserves?

CHAPTER 1

Page 3, paragraph 1 - More recent production figures could be used here. The paragraph would read, "Interior records show that 50.4 million tons of coal were produced from Federal lands in FY '77. Although this isn't much relative to the reserves estimated to be on Federal leases, it is an eight-fold increase * * *."

Page 3, paragraph 3 - As written, this paragraph does not give the Department credit for establishing minimum production levels prior to enactment of the Federal Coal Leasing Amendments Act of 1975. Yet, this fact is recognized in the last statement on page 5 and in paragraph 2 on page 26 by reference to dates.

Page 4, paragraph 2 - The last function (relating to royalty interest taken in kind) does not apply to coal. It is inappropriate to list as a function in a discussion on coal.

Page 5, beginning on line 2 - GAO states that the estimates did not adhere to Survey's own estimating criteria and did not consider economic factors. If GAO is referring to the criteria and methodology in USGS Bulletin 1450-B, which GAO used (page 8), the Bulletin did not exist in 1973. The instructions outstanding in field offices for calculating reserves in November 1973 are contained in the Division Chief's memorandum of June 1973 and are based on USGS Professional Paper 820. While economic factors were not considered explicitly (specific costs and prices), they were considered implicitly under the philosophy of "workability" which was the concept in use at the time. Workability means, under current technology and practice, were similar beds of coal being mined elsewhere under similar conditions?

CHAPTER 2

Page 10, paragraph 2, table - The surface coal estimates of the Survey and leaseholders are within an accuracy of 20 percent and meet the criterion for quantity specified in both the memorandum of November 14, 1973, from the Chief, Conservation Division, and USGS Bulletin 1450-B. The Survey's underground coal reserve estimate is higher than the leaseholders for the probable reasons stated on page 18. Although many leaseholders recognize the existence of underground coal, they plan to operate surface mines and simply do not consider the underground coal to be reserves. However, the Survey is obligated to consider all coal on the leasehold in its calculation of reserves. In part to solve this problem, the Survey has initiated a proposal within the Department to lease coal beds by horizon, leasing only the coal beds of current interest. There are other problems associated with leasing all the coal beds in a tract of land that support the Survey's initiative.

Page 11, paragraph 2 - It is not possible to analyze these figures without going back to specific leases. However, it is apparent from all reserve estimates provided in the report that the Survey's estimates were well within the accuracy criterion mentioned above. GAO's one year of effort analyzing reserves on 219 leases, with the use of additional purchased private data (page 6), confirms the Survey's results obtained in 30 days on 536 leases and demonstrates that the Survey's effort to provide the Department with a "bulk" figure of coal reserves under lease was credible.

- Page 12, paragraph 2 - The last statement is untrue. Leaseholders must submit reserve estimates with a mining plan under 30 CFR 211, Coal Mining Operating Regulations. At the time of mining plan submittal, differences in reserve estimates calculated by leaseholders and the Survey would be surfaced and resolved. Therefore, pages 26 - 33 of this chapter are erroneous as there will be no inequities to either the leaseholder or the Government because of overstated or understated diligent development, advance royalty, or continued operations requirements.
- Pages 16 and 17, paragraph 1 - The use of two decimal places to report coal seam thickness represents a gross exaggeration on the "accuracy" with which these values are known. The same is true in the use of three decimal places for the recovery factors. The significance of the resulting tonnage values should at best not exceed two significant figures.
- Page 18, last line - A determination by the present operator not to disturb coal in underground minable beds would most frequently have no impact on the possibility of that coal being mined at sometime in the future under a new lease.
- Page 20, paragraph 2 - We are pleased that the Survey's and GAO's "surface tonnage" estimates are within 1 percent. For the "underground tonnage" GAO is considerably higher, but GAO concedes on page 21 that no attempt was made to evaluate underground seams based on economics or safety and admits that either could affect "recoverable tonnage" estimates. GAO is confusing resources with reserves.
- Page 21 - For general note, GAO estimates not including additional seams were 3 percent lower than GS estimates and GAO estimates including the additional seams were 0.7 percent higher. Considering the short time GS has for its original estimates and the potential variance between estimators, the differences appear to be insignificant.
- Page 23, paragraph 1 - The Survey does in fact receive pricing information with quarterly royalty reports on producing mines. The Survey develops its own cost information for evaluation purposes, as GAO recognizes it should.

Page 24, paragraph 1 - Again, "surface coal" estimates are well within established limits of accuracy. As previously noted, leaseholders often recognize the existence of underground coal, but plan to operate surface mines and do not consider the underground coal to be reserves (page 18).

CHAPTER 3

Page 38, paragraph 3 - GAO has criticized the Department for the length of time required to approve a mining plan without analyzing the reasons for the timeframe and justifying the criticism.

Page 39 - Approval of the mining plan required approval of an EIS. Until the Programmatic EIS for coal leasing received approval, all activities had to be held in abeyance. Three years is an inordinate amount of delay, but legal barriers prevented any attempt to speed up the process.

Bureau of Mines

Comments on GAO Draft Report
"A Study of Western Coal
Under Federal Lease--Reserves and Production"

The Bureau of Mines was not involved in the coal reserve and production projection estimates and therefore has no basis for analyzing the correctness of the numbers in dispute. However, we would like to offer a few general comments.

To begin with, it seems that the GAO report uses resources and reserves interchangeably, which, if so, would make a great deal of difference in the tonnage figures presented. Until this is clarified, we would have to say that the findings of the report are suspect, even though there may be some substance to them.

It also seems that in the circumstances, a charter to complete the 1973 assignment in 30 days, the Survey did a credible job. To achieve the level of accuracy inferred to be required by the report, thousands of manhours, including many more field investigations would have been necessary. It seems incongruous to expect the Survey's raw estimates to compare closely with those of the leaseholder who has probably done a great deal of subsequent exploration and development work in preparation for production. Although it would have been gratifying to have a closer comparison, we see nothing unethical in the observed "discrepancies."

The report infers that the Federal Government would be damaged by the failure to know the exact tonnage with respect to diligent development and continuous operation. We cannot agree. While revenues from royalties might be stretched-out, the Government would receive its statutory share, even the additional revenue for the amount of coal greater than that originally estimated. It should be remembered that the diligent development/continuous operation requirements did not come into play until passage of the "Federal Coal Leasing Amendments Act of 1975" that was passed August 4, 1976, and for which regulations were promulgated December 22, 1976, nearly 4 years after the original estimates.

It is also worthwhile to note that the Department was in the third year of its leasing moratorium (May 1971) and that the original estimates were part of an assessment of the overall leasing program that had as an objective a leasing program (EMARS) more responsive to national needs rather than reacting to industry lease applications.

Finally, we question whether some of the recommendations directing the Secretary of the Interior to take certain actions are legally permissible in light of the "Department of Energy Organization Act" of August 4, 1977.

While the objectives of accurate estimates are laudable, a balance with reality must be recognized. Under the circumstances, we wonder whether the inordinately high costs to achieve the level of required accuracy inferred in the GAO report would be of significant additional benefit to the Federal Government.

Office of Minerals Policy and Research Analysis

Comments on GAO Draft Report
"A Study of Western Coal
Under Federal Lease--Reserves and Production"

GAO's draft report contains several potentially valuable recommendations. However, the draft is so seriously flawed, in both content and style, that the recommendations lack credibility.

The basic points made in the draft are that more accurate reserve information will lead to better program management, and that leaseholders can contribute to improved information concerning their leases. These are valid points, and deserve attention by USGS. Lacking in the report is any idea of cost effectiveness for either improved information or changes in the data system. Reserve estimates should be as accurate as possible for a given expenditure level. As with any information gathering program, the basic question is how much should be spent to prepare reserve estimates, given that reserve estimation is fraught with problems of accurately measuring or estimating the values used in the calculations. As GAO states on page 45, "If the Survey followed a uniform basis for estimating reserves, the reliability of the estimate would increase". That point is sound, but GAO confuses accuracy with preciseness. Preciseness does not mean reliability. It only means that a calculation was continued farther than one with a less reliable result. It must be remembered that if one number in the calculation is not accurate, the entire calculation is not accurate. The failure to see that cost effectiveness should be estimated before any accuracy goals are set are typical of an apparently hurried writing job. The tone of the report detracts from the content, but this is typical of many such reports. Some specific comments follow:

- pp. 11, 12, 29, and 31 - The reserve and lease figures on these pages do not agree.
- p. 21, last paragraph - GAO "estimates" recoverable underground coal, but ignores economics and safety although both are mentioned as factors "which could affect recoverable tonnage estimates." In point of fact, these two determinants (assuming that "safety" implies technical feasibility) largely define underground coal as recoverable or not recoverable. These estimates are merely resource estimates, not recoverable coal estimates.
- p. 30, first paragraph - Given GAO's questionable estimates of recoverable underground coal, these figures are unlikely to have much accuracy, even though the point made is well taken.

- p. 34 - In the first paragraph, lack of demand is cited by leaseholders as a reason for not producing. In Chapter 1, future demand is seen by GAO to be so constrained that significant production increases will be difficult to achieve. On page 45, leaseholders' reasons for not producing are described as appearing to be "fallacious for the most part." A brief review of coal demand trends, perhaps from an earlier GAO report, may resolve these inconsistencies.
- A source of continuing confusion, throughout the draft, is a failure to indicate whether a rate or total is being used in describing production.

COAL CLASSIFICATION CRITERIA OF GEOLOGICAL SURVEY BULLETIN 1450-B

Resource category (note a)	Reliability category (distance from point of observation)	Resource classification by type of coal					
		Anthracite and Bituminous coal		Subbituminous coal		Lignite	
		Seam depth (feet)	Seam thickness (inches)	Seam depth (feet)	Seam thickness (inches)	Seam depth (feet)	Seam thickness (inches)
Identified resources:							
Reserves (in place)							
--measured	1/4 mile	0-1,000	28 and over	0-1,000	60 and over	0-120	60 and over
--indicated	1/4 mile to 3/4 mile						
--inferred	3/4 mile to 3 miles						
Subeconomic resources							
--measured	1/4 mile	0-1,000	14-28	0-1,000	30-60	0-120	30-60
--indicated	1/4 mile to 3/4 mile	1,000-6,000	14 and over	1,000-6,000	30 and over	120-6,000	30 and over
--inferred	3/4 mile to 3 miles						
Undiscovered resources		0-6,000	14 and over	0-6,000	30 and over	0-6,000	30 and over

a/Resource categories are defined in the glossary.

FEDERAL COAL LEASEHOLDERS INCLUDED IN OUR REVIEW
(In order of the Interior estimate of recoverable reserves)

<u>Leaseholder</u>	<u>Total Federal leases</u>	<u>Total PRLAs</u>
1. Carter Oil Company	3	0
2. Peabody Coal Company	45	16
3. Rochelle Coal Company	2	0
4. Atlantic-Richfield Company	6	3
5. Usibelli Coal Mining Company	3	0
6. Consolidation Coal Company	25	9
7. Meadowlark Farms	2	3
8. Kerr-McGee Corporation	6	0
9. Pacific Power and Light	16	0
10. Resources Company	21	0
11. Texaco, Inc.	5	0
12. El Paso Natural Gas Company	16	0
13. Cordero Mining	1	0
14. U.S. Steel Corporation	19	0
15. Kemmerer Coal Company	16	12
16. Utah International, Inc.	26	2
17. Mobil Oil Company	1	9
18. Decker Coal Company	3	0
19. Belco Petroleum Corporation	2	0
20. Richard D. Bass	<u>1</u>	<u>0</u>
Total	<u>219</u>	<u>54</u>